

## DIVISION 15 – MECHANICAL

### SECTION 15900

#### CHEMICAL FEED AND STORAGE SYSTEM

##### PART 1 - GENERAL

###### 1.1 SCOPE

- A. Work under this section includes a complete Bioxide<sup>®</sup> chemical feed system for the control of hydrogen sulfide. The system shall consist of a feed system composed of chemical feed pumps, feed controls, liquid storage tanks, and all piping and appurtenances required to feed Bioxide<sup>®</sup> into the leachate T-1 tank prior to the pump station, and one full load of Bioxide<sup>®</sup> product to facilitate start-up and the optimization of the system. All materials shall be provided in accordance with these specifications.
- B. All components of the system shall be compatible with the conditions and chemicals to which they are subjected to during the normal operation of the system. Compounds with which the materials must be compatible include, but are not limited to:
  - 1. Hydrogen Sulfide
  - 2. Bioxide<sup>®</sup> solution

###### 1.2 PROCESS DESCRIPTION

- A. The system shall provide for bulk storage of Bioxide<sup>®</sup> and metering of the Bioxide<sup>®</sup> from the bulk storage tank to the wastewater collection system. The system shall contain controls as necessary to facilitate variation in feed rates over a 24-hr period. calibration cylinder shall be permanently installed to facilitate calibration of feed umps.

The Bioxide<sup>®</sup> material shall utilize the inherent ability of the facultative bacteria normally present in wastewater to metabolize hydrogen sulfide and other odor-causing, reduced sulfur containing compounds. The material shall provide nitrate-oxygen to the wastewater to support this biochemical mechanism. This nitrate-oxygen shall be applied via nitrate salts. The material shall be chemically stable, allowing continuous removal of sulfide contributed by side streams downstream of the application point. As a result of the biochemical process, the material shall provide the additional benefit of biochemical oxygen demand (BOD) reduction in the wastewater.

This process is described and protected by United States Patent Number Re #36,651 and Re #37,181.

### 1.3 MANUFACTURER

- A. All components of the feed system shall be provided by a single manufacturer who shall have sole-source responsibility for the system.
- B. The manufacturer of this equipment shall be one recognized and established in the design, production, and operation of chemical feed injection systems. The manufacturer shall provide, with the submittal data, a list of 10 systems in operation using Bioxide® for the control of hydrogen sulfide and other odor causing components associated with municipal wastewater. These systems must have been in operation at least five years. The list shall include correct names, phone numbers, length of service and design criteria.
- C. The manufacturer shall maintain regular production facilities at their place of business. These facilities shall be open for inspection by a representative of the Owner or Engineer at any time during construction and testing of this equipment.
- D. The manufacturer of the feed system shall be an Underwriters Laboratories listed manufacturer of Enclosed Industrial Control Panels.
- E. The system shall be provided by Siemens Water Technologies Corp. of Sarasota, Florida, 1-302-521-3934 or by LCSA pre-approved equal.

### 1.4 SUBMITTAL

- A. The contractor shall submit complete shop drawings and engineering data to the Engineer. These submittals shall include, at a minimum:
  - 1. Drawings showing plan and elevation views of the feed system
  - 2. Control system layout drawing
  - 3. Control systems electrical diagram
  - 4. Manufacture's catalogue information on major system components including, but not limited to:
    - a. Chemical Feed Pumps
    - b. Bioxide® Feed Controls
    - c. Liquid Storage Tank
  - 5. Statement of design conditions and performance guarantee
  - 6. Statement of warranty
  - 7. Reference list as described in section 1.03, B above
- B. The manufacturer shall submit complete Operation and Maintenance manuals to the Engineer. These manuals shall include at a minimum:

1. Information in hazards associated with the system and the appropriate safety precautions
2. Material Safety Data Sheet- Bioxide®
3. Equipment installation instructions
4. Equipment startup instructions
5. Equipment maintenance procedures
6. Troubleshooting guide
7. Individual operation and maintenance information on major system components, including but not limited to:
  - a. Chemical Feed Pumps
  - b. Bioxide® Feed Controls
  - c. Liquid Storage Tank

#### 1.5 SUBSTITUTIONS

Any substitutions or deviations in equipment or arrangement from that shown on the drawings specified herein shall be the responsibility of the Manufacturer or Contractor. Any deviations must be accompanied by detailed structural, mechanical, electrical drawings and data for review by the Engineer. All costs associated with review of the substitutions or deviations and costs associated with project drawing changes as a result of approval shall be borne by the Manufacturer or Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

### PART 2 - PRODUCTS

#### 2.1 BIOXIDE® PRODUCT INFORMATION

##### A. Technical Requirements

1. The material supplied shall be an aqueous solution of calcium nitrate containing a minimum of 3.5 pounds of nitrate-oxygen per gallon.
2. The material shall be capable of reducing the dissolved hydrogen sulfide concentration in leachate (see attached chemical analysis data).
3. The material shall be free of any objectionable odor-producing compounds.
4. The pH of the material shall not be less than 4.0 nor greater than 7.5.

##### B. Safety Requirements

1. The material shall contain no hazardous substances as defined by both the Federal EPA's and State CERCLA lists.

2. The material shall be exempt from Federal DOT placard requirements.
3. Recommended handling procedures for the material shall require protective gloves and safety glasses only. Any material recommending more sophisticated equipment (i.e., face shield, body suit, etc.) during routine handling shall not be considered.

## 2.2 CHEMICAL STORAGE TANKS - (GENERAL)

The chemical storage tank shall be constructed of Rotationally Molded High-Density Crosslinked Polyethylene (HDXLPE). No other material of construction shall be acceptable.

- A. High density crosslinked polyethylene tanks shall be manufactured by the rotational molding process in accordance with ASTM D 1998-93 Standard Specification for Polyethylene Upright Storage Tanks, Type 1 only. Rotational Molding shall be defined as a three-stage process consisting of loading the mold with powdered resin, fusing the resin by heating while rotating the mold about more than one axis, and cooling and removing the molded article.
- B. Plastics. The molding powder used shall be Marlex CL-250 or CL-200 as manufactured by Phillips 66, or powders of equal physical and chemical properties.
  1. The polyethylene shall preferably be virgin material. Any use of regrind, recycled, or reprocessed materials or combinations of such materials shall not rely upon the performance data of their original constituents, but must meet the requirements of this standard in its own right.
  2. The polyethylene shall have a stress-cracking resistance of 500 h minimum F50 in accordance with Test Method D 1693, Condition A, full-strength stress-cracking agent. The test specimens may be compression molded or rotationally molded. If compression molded, Procedure C of Practice D 1928 shall be followed for both types of polyethylene with a minimum platen temperature of 350 °F (177 °C). If it is crosslinkable polyethylene the temperature shall be 390 °F (197 °C) and the platen shall be kept closed under full pressure for 5 minutes at the specified temperature in order to bring about the crosslinking reaction. If the test specimens are rotationally molded, the conditions for rotational molding shall be similar to the conditions used for molding a vessel from this polyethylene.
- C. Fillers and Pigments. The plastic shall contain no fillers. All plastic shall contain an ultraviolet stabilizer at a level adequate to give protection for the intended service life of the vessel, minimum of 0.25%. This stabilizer shall be compounded in the polyethylene. Pigments must be compounded at the same time of resin manufacture.
- D. Vessel Construction
  1. Mechanical properties. The nominal value for the properties of the materials shall be based on the molded parts:

Property	ASTM	Value	Units
Density	D105	59(0.937-0.944)	Lb/ft <sup>3</sup> (S.G.)
ESCR spec. thickness 0.125"	D1693	900-1000	Hrs.
Tensile Strength Ultimate 2"/min.	D638 Type IV	2600	PSI
Elongation at Break 2"/min.	D638 Type IV	450	%
Vicat Softening Temp.	D1525	255	<sup>0</sup> F
Brittleness Temp.	D746	-180	<sup>0</sup> F
Flexural Modulus	D790	100,000-110,000	PSI

2. Design Parameters.

- a. Hoop Stress. The vessels shall be designed with a hoop stress value no greater than 600 psi at 100 <sup>0</sup>F with a safety factor of no less than 2, using the Barlow Formula for calculating wall thickness.
  - b. Wall Thickness. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the Barlow Formula. The wall thickness shall be based on the maximum temperature of the service.
3. Cut edges. All edges where openings are cut into the vessel shall be trimmed smooth.
4. Appearance. Type 1 finished vessel walls shall be free, as commercially practicable of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking, and delaminations that will impair the serviceability of the vessel.
5. Dimensions and Tolerance. The vessel diameter shall be measured externally. The tolerances on the outside diameter, including out of roundness, shall be plus or minus 1 percent. Measurement shall be taken in a vertical position.

#### E. Fittings

1. All fittings with the exception of the overfill protection site glass, shall be located on the tank top or dome. No penetration of the tank side-wall shall be made.
2. Plastic Fittings. Plastic fittings shall be "bulk-head" or "two-flange" style and shall be constructed of PVC. There shall be 4 bolts on any bolted flanges up to and including 3 inch, 8 bolts on fittings 4 inch - 8 inch diameter, and 12 bolts on 10 inch - 12 inch fittings. All bolts shall be all thread design with heads completely encapsulated in polyethylene. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4" of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material: (Green-316 grade S.S., Red-Hastelloy "C", Blue-Monel, Black-Titanium). Each bolt shall have a gasket, which is on the inside of the vessel.
3. Openings that are cut in vessel to install fittings shall not have sharp corners. Holes shall have minimum clearance to insure best performance of fittings.
4. For all flanged connectors, the flange drilling and bolting shall be in accordance with ANSI/ASME B-16.5 for 150-psi pressure class straddling the principle centerline of the vessel.

#### F. Tank Manway Covers

1. Manway covers shall be 15-24-inch diameter.
2. Manway covers shall have either a threaded or bolted cover or gasket

### 2.3 CHEMICAL STORAGE TANK - SPECIFICATIONS

The chemical storage tank shall have the following capacity and approximate dimensions (+/- 5%):

Parameter	Chemical Tanks
Nominal Capacity	2,400 U.S. gal
Diameter	8'
Height	8'
Empty Weight	620 lb.
Specific Gravity	1.65

### 2.4 BIOXIDE<sup>®</sup> FEED CONTROLS

- A. General. The operation of the Chemical Feed System shall be controlled from a Control Panel. All equipment control switches, pilot lights, controllers, etc. and

the chemical feed pumps shall be housed in this panel. The control system shall be UL Approved and shall bear the UL Listed Enclosed Industrial Control Panel Label.

- B. Enclosure. The control panel enclosure shall be constructed of 316 stainless steel and shall be rated NEMA 3R. It shall be equipped with a door with a continuous hinge. The hinged door shall have two latches and shall be capable of locking via a padlock. The enclosure shall be mounted on the control stand, which shall contain the calibration stand.
- C. Components. The Control Box Shall Contain the following:
  - 2- 24 Hour Time Clocks
  - 1- 15 Amp Circuit Breaker, 115 volt
  - 1- Ground Fault Receptacle
  - 5- On/Off Switches with LED Indicator Lights
  - 2- Chemical Feed Pumps
  - 1- Cooling Fan
  - 2- Dry Contact to Receive Signal From Remote Source
  - \*- Ability to provide chemical pump run status signal to SCADA system.
- D. Controls Layout. All manually operated controls (control switches, pilot lights, etc.) shall be located on a panel behind the enclosure door. The panel shall be outfitted with a main power disconnect located in the Control Stand.
- E. Standards. All control system design, fabrication, and wiring shall conform to the standards of Underwriter's Laboratories, National Electrical Code, and any other applicable federal, state, or local codes.
- F. System Operation. Chemical Feed Pumps. A three-position MODE SELECT switch shall be provided. The MODE SELECT SWITCH shall allow the chemical pumps to be operated in 1.) the TIMER mode 2.) the PUMP STATION mode and 3.) the Both mode. In the TIMER mode, the timers shall control operation of the chemical pumps. In the PUMP STATION mode, the operation of the leachate pumps shall energize the chemical feed pumps. In the BOTH mode, either the timers or the operation of the leachate pumps will control the operation of the chemical feed pumps.

The chemical pumps shall be controlled by the MODE SELECT switch and a three position HAND/OFF/AUTO switch. When the mode select switch is in the TIMER MODE and the chemical pump is in the AUTO position, the pump shall be controlled by the timer. The timer shall turn the pump on and off based upon preset time intervals. When the MODE SELECT switch is in the PUMP STATION mode and the pump is in the AUTO position, the pump will be energized when the leachate pumps are in operation. When the MODE SELECT switch is in the BOTH mode and the pump is in the AUTO position, the pump will be controlled by either the timer or the operation of the leachate pumps.

When in the HAND position the chemical pump shall run continuously, regardless of the preset timer intervals or the operation of the sewage pumps. Either one or both chemical feed pumps may turn on or off at preset speeds and preset times.

- G. Control Stand. Pump control box shall be mounted on a 316 stainless steel pedestal.
1. Calibration Cylinder. The stand shall be used to house a calibration cylinder used to measure the chemical being injected into the system. A 3 way valve shall be located at the top and bottom of the calibration tube to facilitate flow measurement. Access inside this pedestal shall be accomplished through a door located on the front of the pedestal. Instructions for use of this cylinder shall be permanently affixed to the interior of the enclosure.
  2. Disconnect Switch. A main power disconnect shall be located in the control stand.

## 2.5 CHEMICAL FEED PUMPS

1. General. Provide Siemens Bellows Pump(s) as shown on the following table. Each pump shall include motor, base, sealed bearings, flexible coupling and check valve filters.

Quantity	Model No.	Adjustable Flow Rate Range (mL/min)	Max Discharge Pressure (psi)
2-Installed	15907-001	5 – 50	40
1-Spare	15907-001	5 - 50	40

2. Performance. Pump rates and maximum discharge pressures shall be in accordance with the table above.
  - a. The pumps shall be self-priming capable of suction lifts, when dry, up to seven (7) feet, and with bellows full, they will prime up to twenty (20) feet.
  - b. Flow rate of each pump shall be adjustable by (a) diameter of bellows, and (b) adjustment of stroke length. A calibration cylinder and valves will be installed to calibrate pump feed rates.
  - c. Pump suction and discharge shall be 3/8" ID polypropylene barbed connection for "T" tubing. A 1-1/2" wye strainer will be installed.



3. Construction.

Material  
Reference

Material

Bellows	Polypropylene
Poppet valves	EPT®
O-rings	EPT®
Springs	Hastelloy C

4. Motors. Motor shall be totally enclosed 115 volt, 60 Hz, 0.034 HP, single-phase and shall be rated for continuous duty.
5. Spare Bellows. The supplier shall also provide two (2) 1-1/2" bellows. When installed on the pumps provided, these larger diameter bellows will produce the following feed rates:

Model No.	Adjustable Flow Rate Range (mL/min)	Max Discharge Pressure (psi)
15907-001	10 – 105	20

2.6 PIPING & APPURTENANCES

- A. All discharge piping shall be standard ½", Polyethylene Tubing OR Schedule 80 PVC. All valves, fittings, and connectors shall be Schedule 80 PVC. The buried encasement piping shall be 2", Schedule 40 piping and appurtenances shall be provided by the Contractor.
- B. All suction piping shall be standard ½", Schedule 80 PVC. All valves, fittings, and connectors shall be Schedule 80 PVC.
- C. All fill line piping shall be 2" Schedule 80 PVC. All fill line valves, fittings, and connectors shall be Schedule 80 PVC.
- D. Fill line shall have a 2" stainless steel male camlock with a 2" plastic female camlock cap.
- E. All chemical feed seals shall be compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the feed system.
- F. All fittings shall be solvent-welded or threaded.

2.7 TANK LEVEL INDICATION SYSTEM

Provide one pressure transducing tank level indicator. The system shall utilize a pressure sensing device to measure the tank liquid level. The system will have a local display.

The system shall contain 3 adjustable relays to allow for alarms and other electrical uses as well as one 4 – 20 mA output.

## PART 3 - EXECUTION

### 3.1 SITE AND UTILITIES

The feed system, Bioxide<sup>®</sup> tanks, and other appurtenances shall be located on a foundation as shown in drawing. The following utilities shall be provided at the feed system site and located as shown on the drawing. Site preparation, utility services, and installation are not provided by the Manufacturer under these specifications.

- A. Electrical. One 120 VAC, 60 Hz, 15 amp single-phase electrical service shall be required.
- B. Concrete Foundation
- C. Dry contacts in Leachate Pump control panel and all wiring to allow for LIFT STATION mode operation.

### 3.2 EQUIPMENT SHOP TESTING

Before shipping the equipment, the Manufacturer shall perform shop tests. These tests shall include at a minimum:

- A. Visual inspection of all equipment.
- B. Complete assembly, start-up, and “wet-test” of feed pumps and calibration piping.

### 3.3 INSTALLATION

The system shall be installed in accordance with the manufacturer’s instructions. All installation personnel shall be trained and qualified in the areas of plumbing, electrical work, and instrumentation as required to complete the installation.

### 3.4 FIELD TESTS

- A. The performance of the system shall be demonstrated to reduce hydrogen sulfide to meet with the odor control levels set forth in these Specifications per manufacturer’s standard practice.
- B. If required, Contractor shall make any changes to the system, at his own expense, that may be necessary to assure satisfactory and efficient operation of this system.

#### PART 4 - WARRANTY

The Manufacturer shall guarantee that the Chemical Feed & Storage system will perform as described in these Specifications. The Manufacturer shall warrant the system, complete, to be free from defects in materials or workmanship for a period twelve (12) months from acceptance or eighteen (18) months from shipment, whichever occurs first. The Manufacturer shall repair or provide replacement for any defective components under this warranty. In addition, the chemical storage tank shall be warranted for a period of five (5) years from warranty start date.